Terahertz Wave Emission from Intrinsic Josephson Junctions in $Bi_2Sr_2CaCu_2O_{8+\delta}$

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The discovery of strong, coherent, continuous and monochromatic electromagnetic wave emission at a terahertz region from high T_c superconductor $Bi_2Sr_2CaCu_2O_{8+\delta}$ intrinsic Josephson junctions (IJJ's) has attracted much attention to the researchers working in fundamental physics as well as many applied scientists and engineers, since they are stimulated to envision the useful applications for the next generation human society. The basic mechanism of the emission by now can be attributed to the ac-Josephson effect, which drives an ac-oscillating current through whole IJJ's connected in series and the additional resonance mechanism, which enhances the self-oscillating ac-Josephson current by the cavity amplification effect. This understanding is brought by the detailed studies of emission patterns of many mesas in relation with the geometrical shape of them in comparison with the theoretical model calculations[1]. It is not entirely trivial why such a coherent coupling is established in only a certain arbitrary fixed number of junctions, what controls the frequency of the emission, *etc.*[2] We argue the importance of nonlinearlity and nonequilibrium conditions, and the role of cavity resonance to the coherent coupling between IJJ's.

[1]K. Kadowaki *et al.*, J. Phys. Soc. Jpn., **79** (2010) 023703, R. A. Klemm *et al.*, J. Phys. Condens. Matter **22** (2010) 375701, T. Kashiwagi, *et al.*, to be published in Phys. Rev. B.
[2]M. Tsujimoto, *et al.*, Phys. Rev. Lett. **105** (2010) 037005.